# QUALITY ASSURANCE PROJECT PLAN

## FOR

## Vasquez Blvd-I70
## Bioavailability of Lead in Site Soils
## Using Juvenile Swine as an Animal Model

**October 2000**

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Denver, CO

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Program Approval date
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10/30/2000

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## A3 Distribution List

This Vasquez Boulevard and I-70 Bioavailability of Lead in Juvenile Swine Project Plan and any revisions will be distributed as follows:

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# A4. PROJECT TASK ORGANIZATION

## A4.1 Project Task

EPA Region 8 is seeking to characterize the bioavailability of lead in soils at the Vasquez Boulevard and I-70 (VB-I70) Superfund Site using juvenile swine as an animal model. This document serves as the Analysis Plan and Quality Assurance Project Plan (QAPP) for the project and presents the organization, objectives, functional activities and specific quality assurance and quality control activities associated with the study. This QAPP includes study background information, project objectives and scope, analytical design and rationale, and data quality objectives (DQOs). It describes the specific protocols that will be followed for obtaining study materials, implementing the study, processing and storing of samples, preparing chain of custody forms, and conducting laboratory analyses.

## A4.2 Project Organization

The following lists key personnel who will serve as contacts and provide technical expertise during implementation of this Project Plan along with their designated roles and responsibilities.

Bonita Lavelle, EPA Remedial Project Manager, will be responsible for overall project management, technical oversight and coordination among EPA and its contractors and other interested parties.

Stan Casteel, DVM, PhD, Principal Investigator, will be responsible for implementing and documenting all activities associated with dosing animals and collecting samples.

Christopher P. Weis, Ph.D., EPA Regional Toxicologist, will serve as the primary scientific contact for this project.

William Brattin, Ph.D., Syracuse Research Corporation (SRC) will be responsible for technical management of SRC's activities which include: preparing planning documents, providing technical oversight, and compiling and summarizing data generated during the investigation.

Tracy Hammon, M.S., SRC., will be responsible for preparation of study investigation materials including; chain of custody forms, time details and dosing spreadsheets. In addition, Ms. Hammon will perform the data reduction for results from this study and calculate a bioavailability value for lead in juvenile swine.

John Drexler, Ph.D., University of Colorado, will be responsible for performing analytical measurements of surface soil samples for lead phase speciation and in vitro bioaccessibility.

# A5 PROBLEM DEFINITION and BACKGROUND

## A5.1 Background

The VB-I70 Superfund Site is located in the north-central area of Denver Colorado. Because the area is in close proximity to several historic smelters, investigations have been conducted to determine levels of smelter-related contaminants in area soils.

The Colorado Department of Public Health and Environment (CDPHE) collected approximately twenty-five soil samples from residential yards in the VB-I70 study area during the summer of 1997. Samples were collected from yards north of Interstate 70 in the Swansea and Elyria neighborhoods. The samples indicated levels of arsenic from 12 to 1,300 mg/kg, and lead from 61 to 660 mg/kg. This discovery prompted further investigation to determine the extent of lead and aresnic present in this area.

During the spring of 1998, the USEPA Superfund Technical Assessment and Response Team (START) conducted further sampling and analysis in the area. Samples were again collected from residences in the Elyria and Swansea neighborhoods bounded by Colorado Boulevard on the east, the South Platte River on the west, 38$^{th}$ Avenue on the south, and 56$^{th}$ Avenue on the north. An additional 1200 residences were sampled. Of these, 207 properties were found with arsenic greater than 70 mg/kg and 77 properties with lead greater than 500 mg/kg (UOS, 1998). Sampling efforts to date are continuing until the areal extent of the contamination is clearly defined.

In September 1999, EPA Region 8 conducted an *in vivo* bioavailability study for arsenic in site soils. EPA will evaluate the *in vivo* bioavailability of lead in study area soils using juvenile swine as an animal model. This information will be used to help evaluate the potential risk to residents from exposure to lead in site soils.

## A5.2 Problem Definition – Conceptual Model

An as yet unidentified source(s) has led to elevated residential soil concentrations of arsenic and lead, resulting in CERCLA (Superfund) actions by the Environmental Protection Agency (EPA) to assess and abate these hazards to human health and the environment. Accurate assessment of the human health risks resulting from oral exposure to metals requires knowledge of the amount of metal absorbed from the gastrointestinal tract into the body. This information is especially important for metals in soil because metals in soil may exist, at least in part, in a variety of poorly water soluble minerals, and may also exist inside particles of inert matrix such as rock or slag. These chemical and physical properties may tend to influence the absorption (bioavailability) of the metals when ingested. Therefore, reliable site-specific data on metal bioavailability in environmental media of concern increase the accuracy and decrease the uncertainty in human health risk estimates.

This project plan describes the efforts planned by EPA to evaluate the bioavailability of lead in soils from the study area using juvenile swine as an animal model. The overall approach will

follow the methods developed by the EPA and employed in the Phase II Bioavailability Studies (EPA, 1995).

## A6 PROJECT TASK DESCRIPTION

### A6.1 Study Goals

The study goal is to collect data that will allow an accurate evaluation of *in vivo* lead absorption from VB-I70 site-specific soils.

### A6.2 Study Objectives

The objective of this study is to derive a quantitative measure of the *in vivo* bioavailability of lead in site soils using juvenile swine as an animal model. These data will be used to quantitatively and/or qualitatively evaluate the risk from lead in soil to residents of the VB-I70 study area.

## A7 QUALITY OBJECTIVES and CRITERIA for MEASUREMENT DATA

The Data Quality Objectives (DQO) process is an iterative process which is designed to focus on the decisions that must be made and to help ensure that the site activities acquire data that are logical, scientifically defensible, and cost effective. The DQO process is intended to:

1. Ensure that task objectives are clearly defined;
2. Determine anticipated uses of the data;
3. Determine what environmental data are necessary to meet these objectives; and
4. Ensure that the data collected are of adequate quantity and quality for the intended use.

### A7.1 Study Objective DQOs

Two types of objectives are identified in this QAPP: general objectives and data quality objectives (DQOs). General objectives are statements of practical goals that, if realized, will substantially contribute to achieving the purpose of the study. Development of DQOs is a process that is intended to ensure that task objectives are clearly defined and that data collected are appropriate and of sufficient quality to satisfy the objectives. DQOs for each of the study objectives are provided below.

General Objective #1: *to quantify the oral absorption (bioavailability) of lead in site soils.*

Data Quality Objective Process

The three stages of the DQO process are identified below and a discussion of how they have been applied in the study described herein. The three stages are undertaken in an interactive and iterative manner, whereby all the DQO elements are continually reviewed and re-evaluated until there is reasonable assurance that suitable data for decision making will be attained.

- Stage I - Identify Decision Types: Stage I defines the types of decisions that will be made by identifying data uses, evaluating available data, developing a conceptual model, and specifying objectives for the project. The conceptual model facilitates identification of decisions that may be made, the end use of the data collected, and the potential deficiencies in the existing information.

- Stage II - Identify Data Uses/Needs: Stage II stipulates criteria for determining data adequacy. This stage involves specifying the quantity and quality of data necessary to meet the Stage I objectives. EPA's Data Usability for Risk Assessment Guidance (DURA) outlines general and specific recommendations for data adequacy. This includes identification of data uses and data types, and identification of data quality and quantity needs.

- Stage III - Design Data Collection Program: Stage III specifies the methods by which data of acceptable quality and quantity will be obtained for use in decision making. These methods are provided in the attached SOPs.

Through utilization of the DQO process, as defined in EPA guidance (EPA540-R-93-071 and -078, Sep 1993), this QAPP will use several terms that are specifically defined to avoid confusion that might result from any misunderstanding of their use. For each of the tasks identified within this QAPP, a "Task Objective" is specifically defined. The Task Objective is a concise statement of the problem to be addressed by activities under this task. For each Task Objective, a decision (or series of decisions) is identified which addresses the problem contained in the Task Objective.

For each decision, the data necessary to make the decision are identified and described. For all analytical data, quality assurance objectives are specified that describe the minimum quality of data necessary to support the specified decision or test the hypotheses. These quality assurance objectives are specified as objectives for precision, accuracy, representativeness, comparability, and completeness. In addition, data review and validation procedures are specified in the QAPP that evaluate how well the analytical data meet these quality assurance objectives and whether or not the data are of sufficient quality for the intended usage.

The following sections describe Stage I and Stage II of the DQO process at this site. Stage III is discussed later and provides the specific task objectives, decisions, and rationale for resolving the decisions necessary to complete this Study.

**DQO Stage I - Identifying Decision Types**

Stage I of the DQO process identifies a primary question and secondary questions that need to be resolved at the completion of the sampling and analyses program.

- PRIMARY QUESTION: What is the relative bioavailability of lead in site soils compared to a fully soluble form of lead (lead acetate)?

**DQO Stage II - Identifying Data Uses/Needs**

Stage II of the DQO process identifies data uses and needs. The primary uses of data are:

- Compare oral absorption data from site test materials to data from a control material to quantitatively determine the relative bioavailability of lead in site soils.

- Compare site specific bioavailability data to the EPA default value.

In order to accomplish these uses, sample collection will be designed to address these needs by ensuring sufficient samples are collected.

Stage II of the DQO process also determines what type and quality of data are needed to answer the questions developed in Stage I.

1. Data should be collected from a sufficient number of dosing groups and animals within each dosing group.

Within this QAPP, quantitative and qualitative limits are defined for precision, accuracy, representativeness, comparability and analytical completeness. Reporting limits for chemical analytes are set by the analytical laboratory based on matrix, historical data, and comparison to EPA limits for CLP and other methods. Quantitative limits are also defined for instrument and method detection limits, and for method reporting limits or method quantitation limits. The QA procedures outlined in this section are intended to ensure data quality and to administer corrective actions with the goal of producing data that satisfy the following requirements. General guidelines, policies, and procedures to achieve these objectives are presented below. Where additional, detailed, procedures are required to attain QA objectives and to describe specific methods, these are provided in the attached SOPs. SOPs for this project can also be located in EPA, 1995. The following PARCC requirements apply to more standard chemical analytical analyses:

Precision: Precision is defined as the agreement between a set of replicate measurements without assumption or knowledge of the true value. It is a measure of agreement among individual measurements of the same property under prescribed similar conditions. Agreement is expressed as either the relative percent difference (RPD) for duplicate measurements or the range and standard deviation for larger numbers of replicates. The RPD will be reported on required 5% laboratory duplicates, and a defined MDL will be reported as per EPA guidance in CFR, part 136, app. B (7 method-replicates on 3 non-consecutive days of a low-level [near MQL] standard, with MDL = 3 x SD).

Study personnel will prepare blind duplicate samples. A minimum of one blind duplicate will be prepared for 5-10% of the samples collected. These blind duplicate samples will be specified in the study design.

Accuracy: Accuracy is a measure of the closeness of individual measurements to the "true" value. Accuracy usually is expressed as a percentage of that value. For a variety of analytical procedures, standard reference materials traceable to or available from National Institute of Standards and Technology (NIST, formerly National Bureau of Standards) or other sources can be used to determine accuracy of measurements. Accuracy will be measured as the percent recovery (%R) of an analyte in a reference standard or spiked samples (>3) that span the limit of linearity for the method.

Ideally, precision and accuracy estimates should represent the entire measurement process, including sampling, analysis, calibration, and other components. From a practical perspective, these estimates usually represent only a portion of the measurement process that occurs in the analytical lab.

Representativeness: Representativeness is the degree to which data accurately and precisely represent characteristics of a population, parameter variations at a sampling point, or an environmental condition. For this QAPP, the environmental condition being assessed is soil contamination with lead at a level above the EPA default level of concern (400 ppm), and which are not also significantly impacted by arsenic. This class of soil sample is important because it will be lead rather than arsenic which drives decision-making.

Comparability: Data are comparable if study considerations, collection techniques, and measurement procedures, methods, and reporting are equivalent for the samples within a sample set. A qualitative assessment of data comparability will be made of applicable data sets. These criteria allow comparison of data from different sources. Comparable data will be obtained by specifying standard units for physical measurements and standard procedures for sample collection, processing, and analysis.

Completeness: Data are considered complete when a prescribed percentage of the total intended measurements and samples are obtained. Analytical completeness is defined as the percentage of valid analytical results requested, and >90% of analyzed samples should have results reported. For this sampling program, a minimum of 80 percent of the planned collection of individual samples must be obtained to achieve a satisfactory level of data completeness.

Method Detection Limits (applicable to chemical analyses only): Method detection limits (MDLs) are minimum values that can be reliably measured to identify the analyte as being present in the matrix, vs method quantitation limits are the minimum values that can be quantitated with reasonable scientific confidence. The method will also have a maximum linear value in most situations, and analyses should occur within this limit of linearity range.

## B. MEASUREMENT AND DATA ACQUISITION

## B1 SAMPLING PROCESS DESIGN

The USEPA has been engaged in a multi-year investigation of the bioavailability of metals in soil and mine waste. This study will follow the methods and SOPs developed by EPA in previous studies (USEPA 1995).

Two representative site soil samples will be selected for inclusion in this study. SOPs for soil collection and characterization of metal concentrations in the dosing substances may be found in the attached SOP (Memorandum from Kevin Williamson to Bonita Lavelle (10/26/2000). These samples will be administered to juvenile swine for 15 consecutive days using a twice-daily dosing protocol. Blood samples will be collected from the animals according to a defined schedule, and bone, kidney and liver tissue will be collected upon study termination. These samples will be analyzed for lead in order to determine the amount of lead absorbed from the soil. These amounts will be compared to those obtained from a control group of animals which is dosed with lead acetate (PbAc).

This study will be performed using young swine as the test species because the gastrointestinal system of swine is more nearly similar to humans than most other animal models. The animals will be housed individually in metabolic cages. Groups of randomly selected animals (N= 5) will be given oral doses of test material or lead acetate (abbreviated here as PbAc) for a total of 15 days, with the dose for each day being administered in two equal portions given at 9:00 AM and 3:00 PM (two hours before feeding). Control animals (N=3) will be given a dose consisting of vehicle material only. Doses will be based on measured group mean body weights, and will be adjusted every three days to account for animal growth.

The specific test materials have been intentionally left unidentified in this project plan so that the plan may be used for multiple studies of test materials from this site. A memo documenting which test materials were selected for a study will be prepared prior to the commencement of the study. All test materials which are used in the swine bioavailability study will undergo characterization and *in vitro* testing. Characterization will include CLP metals analysis according to EPA method SW-846, and metals speciation according to SOP ISSI VBI70-09 (note: perlite will not be quantified). *In vitro* testing will be performed according to the SOP in Appendix A.6 in the Pilot-Soil Characterization Plan for this site (EPA, 1999).

For animals exposed by the oral route, dose material will be placed in the center of a small portion (about 5 grams) of moistened feed (referred to as a "doughball"), and administered to the animals by hand. All missed doses will be recorded and the time-weighted average dose calculation for each animal will be adjusted downward accordingly.

The following table shows the study design for evaluating the bioavailability of lead in site soils.

| Group | Number of Animals | Material Administered | Dose Route | Dose (ug Pb/kg-day) |
|---|---|---|---|---|
| 1 | 5 | PbAc | Oral | 25 |
| 2 | 5 | PbAc | Oral | 75 |
| 3 | 5 | PbAc | Oral | 225 |
| 4 | 5 | Test Material #1 | Oral | 75 |
| 5 | 5 | Test Material #1 | Oral | 225 |
| 6 | 5 | Test Material #1 | Oral | 500 |
| 7 | 5 | Test Material #2 | Oral | 75 |
| 8 | 5 | Test Material #2 | Oral | 225 |
| 9 | 5 | Test Material #2 | Oral | 500 |
| 10 | 3 | Control | Oral | 0 |

One blood sample (6-8 mL) will be drawn (following SOP #9, EPA 1995) from each animal on days 0, 1, 2, 3, 5, 7, 9, 12, and 15, into a clean plastic lead-free syringe by venipuncture of the anterior vena cava. The blood will be immediately transferred into lead-free Vacutainer$^{R}$ tubes containing EDTA. In each case, blood samples will be drawn 17 hours after the second dosing of the previous day. Animal weights will be recorded and doses and feed adjusted on days -1, 2 and every third day thereafter until study termination. Blood samples will be prepared as per SOP #11 (EPA 1995). Animals will be fed according to the regular daily schedule outlined in the Project Notebook.

On study day #15, pigs will be humanely sacrificed and representative samples of liver, kidney, and bone will be collected and prepared for analysis as per SOP #11 (EPA 1995). Detailed logbook notes will record information pertinent to each sample collection. These notes will be indexed and made available for review following sample collection.

The RBA of lead in site materials will be estimated using the following approach:

1. Plot the biological responses of individual animals exposed to a series of oral doses of soluble lead (e.g., lead acetate). Fit an equation which gives a smooth line through the observed data points.

2. Plot the biological responses of individual animals exposed to a series of doses of test material. Fit an equation which gives a smooth line through the observed data.

3. Using the best fit equations for reference material and test material, calculate RBA as

the ratios of doses of test material and reference material which yield equal biological responses. Depending on the relative shape of the best-fit lines through the lead acetate and test material dose response curves, RBA may either be constant (dose-independent) or variable (dose-dependent).

An RBA value of 1.0 means that lead in the test soil is just as well absorbed as lead acetate. An RBA value of 0.5 means that lead in the test soil is absorbed 50% as well as lead acetate.

## B2 SAMPLING METHODS REQUIREMENTS

The proposed sampling consists of the collection of approximately 500 samples of blood from exposed or control animals and 48 samples each of liver, kidney and bone.

QA/QC samples will consist of blind spikes, media blanks and duplicate samples at a 5-10% rate, and measures of lead in other media to which the swine are exposed (e.g., water, feed). Every reasonable effort will be made to adhere strictly to specified SOPs and laboratory guidelines. Where deviation from SOPs is unavoidable, documentation of the deviation and its potential impact on the outcome of the data collection effort will be documented. Detailed logbook notes will record information pertinent to each sample collection. These notes will be indexed and made available for review following sample collection.

## B3 Sampling, Handling and Custody Requirement

Documentation of sample collection, handling, and shipment will include completion of chain-of-custody forms, use of time details and prepared forms, and entry of data and/or observations into a logbook. A chain-of-custody form shall accompany every shipment of samples to the analytical laboratory. The purpose of the chain-of-custody form is to establish the documentation necessary to trace possession from the time of collection to final disposal.

The chain-of-custody form will have the following information:

- Project number
- Sampler's signature
- Date of sample collection
- Sample medium (e.g., Blood, liver, etc.)
- Sample identification number
- Analytical parameters

The shipping forms or transmittal memo will describe:

- Number of containers
- Sample preservative (dry ice for transit)
- Date and time of sample shipments

The labs will enter the following information upon receipt:

- Name of person receiving the sample
- Date of sample receipt
- Sample condition

All corrections to the chain-of-custody record will be initialed and dated by the person making the corrections. Each chain-of-custody form will include signatures of the appropriate individuals indicated on the form. The originals will accompany the samples to the laboratory, and copies documenting each custody change will be recorded and kept on file.

Chain-of-custody will be maintained until final disposition of the samples by the laboratory and acceptance of analytical results by EPA. One copy of the chain-of-custody will be kept by field personnel.

All required paper work, including sample container labels, chain-of-custody forms, custody seals and shipping forms will be fully completed in ink prior to overnight shipping of the samples to the laboratory.

Upon receipt, coolers containing the biological samples will be received by the laboratory sample custodian. The coolers will be opened and the contents inspected. Chain-of custody forms will be reviewed for completeness, and samples will be logged and assigned a unique laboratory sample number. Any discrepancies or abnormalities in samples will be noted.

The EPA Project Manager will maintain original log books and receive all data packages and reports.

## B4 ANALYTICAL METHODS REQUIREMENTS

See the attached laboratory SOP for analytical methods and requirements.

## B5 Quality Control Requirements

The project team organization ensures attainment of QA objectives by:

- Assigning responsibility for performing work according to specifications
- Providing oversight of quality-related activities for verification of conformance with specifications
- Defining the relationships between management and personnel performing quality-related work Corrective Action

The Project Manager will prepare a summary of quality-related activities and problems. This

summary will be forwarded to EPA for inclusion in the project file. If deficiencies in the program are identified, the Project Manager will identify recommendations for corrective action.

Communications. Lines of communication between project personnel and project management staff will be appropriate to enable timely response to events that have the potential to affect data quality. Project personnel will be provided with a project contact list that includes telephone numbers for both routine communications and emergency notifications.

Communications will also entail ensuring that information on sample collection, transportation, analysis, and storage; data acquisition, analysis, and reporting; personnel assignments and activities; and other information pertinent to the project are distributed to potentially affected personnel in a timely manner. Changes in procedures, equipment, personnel, or other program elements as a result of an accident or emergency that have the potential to affect data quality or achievement of overall program objectives will be communicated to the Project Manager in writing in a timely manner.

Copies of all written communications and written summaries of all substantive telephone conversations will be placed in a permanent project file maintained by the EPA Project Manager.

Laboratory Responsibilities. The laboratory and its staff will have the responsibility for processing all samples submitted according to the specific protocols for sample custody, holding times, analysis, reporting, and associated laboratory QA/QC. Laboratory spikes, duplicates, etc. will be performed.

### B7 INSTRUMENT CALIBRATION and FREQUENCY

SOPs will identify requirements needed to be met by the field staff and laboratories to meet adequate instrument calibration frequency, and QA/QC for raw data and reports.

## C. ASSESSMENT OVERSIGHT

### C1 ASSESSMENTS and RESPONSE ACTIONS

The Principal Investigator will be on-site to oversee, implement and inspect study activities. Enough sample will be taken and archived to allow for problems during shipping or analysis.

## D. DATA VALIDATION and USABILITY

### D1 DATA REVIEW, VALIDATION and VERIFICATION REQUIREMENTS

Data validation will consist of a) establishing an absolute range, acceptance limits (screening criteria), and appropriate statistics for each data parameter, b) describing methods for determining the disposition of suspect data, and c) documenting final disposition of invalid or qualified data, including outliers.

Test Statistic: Qualitative professional judgement will be used to interpret the results of the chemical

and biological data collected which is intended to be screening-level preliminary data.

Out-of-range chemical data will be excluded from the validated data set unless the appropriate data value can be positively established and documented. Other suspect data or samples will be examined in detail, including any irregularities in its collection and handling. In the absence of any clear indication that they are invalid (such as equipment failure or operator error), data outliers will remain in the validated data set but will be flagged as outliers per specified criteria (e.g., >3 x SD from the mean). Data points determined to be invalid will be permanently flagged in a clear and consistent manner in the original raw data set and removed from subsequent data summaries and files.

QA for data validation will ensure that the screening criteria are comprehensive, unambiguous, reasonable, and internally consistent; and that data validation activities are properly documented. Data discrepancy reports should be prepared describing any data problems observed and any data correction activities undertaken.

All data records will be cataloged and stored in their original form. Calibration adjustments and adjustments to reduce data to standard conditions for comparability will be clearly documented, and raw data clearly distinguished from "corrected" data (i.e., data to which calibration and standardization adjustments have been applied).

Raw data and adjustments should be entered into a computer database and/or spreadsheet for correction, statistical analysis, manipulation, formatting, and summarizing to reduce the potential for human error.

## D2 VALIDATION and VERIFICATION METHODS

Data reporting consists of communicating summarized data in a final form. QA for reporting consists of measures intended to avoid or detect human error and to correct identified errors. Such methods include specification of standard reporting formats and contents of measures to reduce data transcription errors. Data will undergo peer review by qualified reviewers capable of evaluating reasonableness of the data for the scientific design.

Reports: A report of all the summary study design characteristics, sample collections and analyses, data quality and results shall be presented by the analytical laboratories. Simple statistical tests of group treatment differences should be performed and presented as discussed above and will be conducted by EPA. All raw data and summary results of both data and summary statistics (means, standard deviations, ranges, etc.) should be tabulated by the laboratories. Study reports should be available within 60 days of receipt of acceptable laboratory results and reports.

QA records and project files will be maintained in accordance with standard project procedures. All QA records, logbooks, sample data forms, raw data summaries, and the like will be maintained until written directions for their disposal are provided.

## D3 RECONCILIATION with DQOs

The project team will review any results which fall outside the DQOs and decide (per DURA 1992 and RAGS 1992) the extent of usability of results for the purposes of this investigation.

## REFERENCES:

DURA. 1992

EPA. 1995. Bioavailability of Metals in Soils and Solid Waste. Standard Operating Procedure. Report prepared for the U.S. Environmental Protection Agency, Region VIII, by Roy F. Weston, Inc. Document Control Number 4800-045-018. June, 1995.

EPA. 1999. Pilot-Scale Soil Characterization Study: Vasquez Boulevard and I-70 Site, Denver, Colorado. Prepared for USEPA Region 8. Prepared by ISSI Consulting Group, Inc. September 1999.

RAGS. 1992. Risk Assessment Guidelines for Superfund. Volume 1. Part A. Human Health. U.S. Environmental Protection Agency.

## E. SOPs

10/26/2000

Washington

# Technical Memorandum

**To:** Bonnie Lavelle

**From:** Kevin Williamson

**REF:** RAC No. 68-W7-0039, WA. No. 004-RICO-089R

**Subject:** VB/I-70 Bio-Availability Soil Sample Preparation

**Cc:** M. Green, B. Meyers, T. Hammonds

In support of the Vasquez Blvd./ I-70 (VB/I-70) risk assessment program, Washington Group International (WGI) was tasked with preparing soil samples for a Bio-Availability study to be performed by EPA Region VIII toxicologists. Soil samples from various residential properties were selected that represent specific concentrations of lead, and arsenic. These soil samples were collected during Phase IIIA and Phase IIIB of the remedial investigation within the neighborhoods of Swansea, Elyria, Cole, Clayton, and the southwest portion of Globeville. Bonnie Lavelle (EPA) instructed WGI to prepare two soil samples for this study representating the Western and Eastern neighborhoods. Soil samples were selected based on previously determined lead (Pb) and arsenic (As) concentrations, as determined using an EDXRF Quanx, and composited in accordance with the attached procedure (Attachment 1). On October 19, 200 twelve soil samples were selected for the East sample, and eight soil samples were selected for the West sample. Based on remaining sample weights and previously measured concentrations, six soil samples were combined to make the East sample, and five soil samples were combined to make the West sample. The following sample IDs were used to make the East sample: 3-03583-B, 3-03588-B, 3-02387-B, 3-08444-B, 3-08978-B, and 3-08979-B. Upon composite of those samples the East sample was designated 3-15621-B. The following sample IDs were used to make the West sample: 3-10740-B, 3-10318-B, 3-03910-B, 3-10734-B, and 3-10319. Upon composite of those samples the West sample was designated 3-15628-B.

On October 20, 2000, soil samples were dried in a laboratory oven at 105 C, bulk sieved with a 2-mm screen, and fine sieved with a 250-mm screen. Bulk and fine fraction samples were split for EDXRF, and TAL metals analysis via Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP) analysis. Two bio-availability test substances were produced consisting of 1.2 and 1.6 kilograms of the fine fraction composite soils. Test substance samples were relinquished under chain of custody to Syracuse Research Center (SRC).

All arsenic and lead soil sample results and corresponding quality control sample results are summarized in the attached tables. Table 1 displays initial XRF screening results to insure study mandated concentration levels. Table 2 displays the bulk and fine sieved fractions also analyzed using XRF. Table 3 displays off-site laboratory
ICP results, with laboratory data sheets included as Attachment 2. Analytical results indicate that the average lead concentrations of the East test substance are 723 mg/kg (ICP) and 788 mg/kg (XRF). Average lead concentrations for the West test substance are 1050 mg/kg (ICP) and 987 mg/kg (XRF). Intra-sample variability is low with the exception of the bulk fraction ICP results.

# Table 1

| Location | Fraction | Sample ID | Parent Sample ID | Results (mg/Kg) | | ICP Results (mg/Kg) | | Date/Time Analyzed |
|---|---|---|---|---|---|---|---|---|
| | | | | Arsenic | Lead | Arsenic | Lead | |
| West | Bulk (Screen) | 3-15628-B | 3-15628-B | 30 | 908 | | | 10/19/2000 @ 1207 |
| West | Bulk (Screen) | 3-15628-B | 3-15628-B | 23 | 764 | | | 10/19/2000 @ 1207 |
| West | Bulk (Screen) | 3-15628-B | 3-15628-B | 30 | 823 | | | 10/19/2000 @ 1207 |
| | | | **Average** | **28** | **832** | | | |
| East | Bulk (Screen) | 3-15621-B | 3-15621-B | 27 | 639 | | | 10/19/2000 @ 1207 |
| East | Bulk (Screen) | 3-15621-B | 3-15621-B | 10 | 658 | | | 10/19/2000 @ 1207 |
| | | | **Average** | **19** | **649** | | | |
| | | NIST2711 | | 88 | 1150 | | | 10/19/2000 @ 1207 |

# Table 2

| Location | Fraction | Sample ID | Parent Sample | Results (mg/Kg) | | ICP Results (mg/Kg) | | Date/Time Analyzed |
|---|---|---|---|---|---|---|---|---|
| | | | | Arsenic | Lead | Arsenic | Lead | |
| West | Bulk | 3-15628-B1 | 3-15628-B | 30 | 983 | | | 10/19/2000 @ 1851 |
| West | Bulk | 3-15628-B2 | 3-15628-B | 22 | 1001 | | | 10/19/2000 @ 1851 |
| West | Bulk | 3-15628-B3 | 3-15628-B | 31 | 1038 | | | 10/19/2000 @ 1851 |
| West | Bulk | 3-15628-B4 | 3-15628-B | 13 | 978 | | | 10/19/2000 @ 1851 |
| West | Bulk | 3-15628-B5 | 3-15628-B | 46 | 960 | | | 10/19/2000 @ 1851 |
| West | Bulk | 3-15628-B6 | 3-15628-B | 26 | 898 | | | 10/19/2000 @ 1851 |
| West | Bulk | 3-15628-B7 | 3-15628-B | 22 | 998 | | | 10/19/2000 @ 1851 |
| West | Bulk | 3-15628-B8 | 3-15628-B | 31 | 1001 | | | 10/19/2000 @ 1851 |
| West | Bulk | 3-15628-B9 | 3-15628-B | 25 | 857 | | | 10/19/2000 @ 1851 |
| | | | **Average** | **27** | **968** | | | |
| West | Fine | 3-15628-F1 | 3-15628-F | 35 | 1062 | | | 10/19/2000 @ 1851 |
| West | Fine | 3-15628-F2 | 3-15628-F | 27 | 1008 | | | 10/19/2000 @ 1851 |
| West | Fine | 3-15628-F3 | 3-15628-F | 27 | 1059 | | | 10/19/2000 @ 1851 |
| West | Fine | 3-15628-F4 | 3-15628-F | 19 | 1052 | | | 10/19/2000 @ 1851 |
| West | Fine | 3-15628-F5 | 3-15628-F | 32 | 1078 | | | 10/19/2000 @ 1851 |
| West | Fine | 3-15628-F6 | 3-15628-F | 41 | 1095 | | | 10/19/2000 @ 1851 |
| West | Fine | 3-15628-F7 | 3-15628-F | 22 | 1008 | | | 10/19/2000 @ 1851 |
| West | Fine | 3-15628-F8 | 3-15628-F | 17 | 1022 | | | 10/19/2000 @ 1851 |
| West | Fine | 3-15628-F9 | 3-15628-F | 23 | 1062 | | | 10/19/2000 @ 1851 |
| | | | **Average** | **27** | **1050** | | | |
| | | NIST2711 | | 99 | 1169 | | | 10/19/2000 @ 1851 |
| | | | | | | | | |
| East | Bulk | 3-15621-B1 | 3-15621-B | 30 | 722 | | | 10/19/2000 @ 1549 |
| East | Bulk | 3-15621-B2 | 3-15621-B | 26 | 721 | | | 10/19/2000 @ 1549 |
| East | Bulk | 3-15621-B3 | 3-15621-B | 26 | 685 | | | 10/19/2000 @ 1549 |
| East | Bulk | 3-15621-B4 | 3-15621-B | 24 | 746 | | | 10/19/2000 @ 1549 |
| East | Bulk | 3-15621-B5 | 3-15621-B | 25 | 746 | | | 10/19/2000 @ 1549 |
| East | Bulk | 3-15621-B6 | 3-15621-B | 21 | 764 | | | 10/19/2000 @ 1549 |
| East | Bulk | 3-15621-B7 | 3-15621-B | 27 | 840 | | | 10/19/2000 @ 1549 |
| East | Bulk | 3-15621-B8 | 3-15621-B | 29 | 702 | | | 10/19/2000 @ 1549 |
| East | Bulk | 3-15621-B9 | 3-15621-B | 10 | 694 | | | 10/19/2000 @ 1549 |
| | | | **Average** | **24** | **736** | | | |
| East | Fine | 3-15621-F1 | 3-15621-F | 9 | 839 | | | 10/19/2000 @ 1549 |
| East | Fine | 3-15621-F2 | 3-15621-F | 17 | 780 | | | 10/19/2000 @ 1549 |
| East | Fine | 3-15621-F3 | 3-15621-F | 14 | 774 | | | 10/19/2000 @ 1549 |
| East | Fine | 3-15621-F4 | 3-15621-F | 18 | 765 | | | 10/19/2000 @ 1549 |
| East | Fine | 3-15621-F5 | 3-15621-F | 17 | 770 | | | 10/19/2000 @ 1549 |
| East | Fine | 3-15621-F6 | 3-15621-F | 16 | 750 | | | 10/19/2000 @ 1549 |
| East | Fine | 3-15621-F7 | 3-15621-F | 33 | 827 | | | 10/19/2000 @ 1549 |
| East | Fine | 3-15621-F8 | 3-15621-F | 22 | 804 | | | 10/19/2000 @ 1549 |
| East | Fine | 3-15621-F9 | 3-15621-F | 16 | 787 | | | 10/19/2000 @ 1549 |
| | | | **Average** | **18** | **788** | | | |
| | | NIST2711 | | 96 | 1168 | | | 10/19/2000 @ 1549 |

# Table 3

| Location | Fraction | Sample ID | Parent Sample | Results (mg/Kg) | | ICP Results (mg/Kg) | | Date/Time Analyzed |
|---|---|---|---|---|---|---|---|---|
| | | | | Arsenic | Lead | Arsenic | Lead | |
| West | Bulk | 3-15703-B | 3-15628-B | | | 10 | 900 | 10/23/00 |
| West | Bulk | 3-15704-B | 3-15628-B | | | 9 | 370 | 10/23/00 |
| West | Bulk | 3-15705-B | 3-15628-B | | | 10 | 400 | 10/23/00 |
| | | | | | **Average** | **10** | **557** | |
| West | Fine | 3-15700-F | 3-15628-F | | | 26 | 970 | 10/23/00 |
| West | Fine | 3-15701-F | 3-15628-F | | | 25 | 1000 | 10/23/00 |
| West | Fine | 3-15702-F | 3-15628-F | | | 24 | 990 | 10/23/00 |
| | | | | | **Average** | **25** | **987** | |
| East | Bulk | 3-15622-B | 3-15621-B | | | 10 | 610 | 10/23/00 |
| East | Bulk | 3-15623-B | 3-15621-B | | | 9 | 1100 | 10/23/00 |
| East | Bulk | 3-15624-B | 3-15621-B | | | 10 | 620 | 10/23/00 |
| | | | | | **Average** | **10** | **777** | |
| East | Fine | 3-15627-F | 3-15621-F | | | 19 | 700 | 10/23/00 |
| East | Fine | 3-15629-F | 3-15621-F | | | 19 | 710 | 10/23/00 |
| East | Fine | 3-15630-F | 3-15621-F | | | 20 | 760 | 10/23/00 |
| | | | | | **Average** | **19** | **723** | |

# ATTACHMENT 1

# BIO-AVAILABILITY SAMPLE PREPARATION PROCEDURE

BIO-AVAILABILITY SOIL SAMPLE PREPARATION PROCEDURE
OCTOBER 2000

RE: RAC No. 68-W7-0039, WA No. 004-RICO-089R (VB/I-70 OU1)

OBJECTIVES:

1. Produce two fine sieved, composite soil samples for use EPA's use in a pig study containing relatively high levels of lead and low levels of arsenic. If possible, one sample should be representative of COLE (and FIVE POINTS) neighborhood soils and one representative of CLAYTON (and SWANSEA) soils.

2. Measure concentrations and variability of both the fine fraction and bulk fraction of the composite using both XRF and ICP.

CONTACTS:

Bonnie Lavelle
303/312-6579, 303/898-8465

Chris Weis
303/312-6671, 720/320-6254 (cell), 800/759-8888 #1083306 (pager)

Tracy Hammond, SRC
303/713-9549

PROCEDURE

I. Identify Samples for Compositing

1. Evaluate list of candidate samples and minimum quantity provided by Tracy along with neighborhood data. Group by 2 neighborhoods WEST and EAST (and other - may not want to include Globeville or Elyria for this study). Calculate average concentration - consult Bonnie if concentration is too low based on Tracy's mass requirements (target 1100-1200 ppm lead); or eliminate samples from consideration that bring the average down.

2. Note that mass of each composite needed is for Test Substance per Tracy's table, PLUS 50 grams, plus 18 XRF samples, plus 6 ICP samples, and plus some if possible for archive.

3. Retrieve samples from archive for each group.

4. Weigh raw samples; Re-evaluate relative contribution (composite design) of samples (maximize volume of higher Pb concentration samples) in order to achieve target/high Pb concentration in composite. If mass is inadequate to generate WEST and EAST composites, consult EPA for guidance on alternative approach targeting 2 different concentration levels.

II. Prepare Composite

1. Weigh out portions/all of the raw samples per composite design and composite into the two Raw samples. Label each uniquely 3-XXXXX-R. Homogenize very well.

2. Thoroughly dry each raw sample. Bulk sieve each entire composite; Label with sample IDs (-B).

3. Prep one XRF cup for each -B and screen by XRF - confirm adequate sample mass for each composite. If mass is low, dry and bulk sieve additional soil (from appropriate EAST or WEST group), re-homogenize, and re-screen -B.

4. Reserve -B sample quantities adequate for 9 XRF samples and 3 ICP samples.

5. Fine sieve (60 mesh) remaining -B sample mass to produce the two composite -F samples.

III. Split Samples - Bulk

1. Split each -B composite into 3 uniquely identified samples and ship for ICP analysis of all EPA Target Analyte List metals (std or 48-hour turnaround **BONNIE: may be easier to submit all for quick turnaround to enable completion of this task next week, rather than get a separate data package in 3+ weeks).

2. Grind / cup 9 aliquots (original sample ID 3-XXXXX-B1 --> B9 *** BONNIE: does this have to be blind to the XRF analyst? If so, assign unique sample IDs) for XRF analysis

IV. Split Samples - Fine

1. Split each -F composite into 3 uniquely identified samples and ship for ICP analysis of all EPA Target Analyte List metals (48-hour turnaround)

2. Grind / cup 9 aliquots for each (original sample ID 3-XXXXX-F1 --> F9 *** BONNIE: does this have to be blind to the XRF analyst? If so, assign unique sample IDs) for XRF analysis

3. Split each remaining -F composite into a 50-gram sample (for physical testing), a required mass of Test Substance, and any remaining quantity for archive; ALL with same original -F sample ID.

4. Transfer Sample consisting of 50-gram and Test Substance portions to Tracy Hammond (phone her for a pick-up) under COC.

VI. XRF Analysis / Reporting

1. Analyze 9 - B and 9 -F samples from each composite together along with NIST standard and blank.

VII. Documentation

1. Produce a Technical Memorandum summarizing task, include: prep log/XRF instrument log/COCs/ICP data received; three copies to Bonnie.

2. FAX ICP data to Bonnie, Chris and Tracy upon receipt.

BIO-AVAILABILITY SOIL SAMPLE PREPARATION PROCEDURE
OCTOBER 2000

RE: RAC No. 68-W7-0039, WA No. 004-RICO-089R (VB/I-70 OU1)

OBJECTIVES:

1. Produce two fine sieved, composite soil samples for use EPA's use in a pig study containing relatively high levels of lead and low levels of arsenic. If possible, one sample should be representative of COLE (and FIVE POINTS) neighborhood soils and one representative of CLAYTON (and SWANSEA) soils.

2. Measure concentrations and variability of both the fine fraction and bulk fraction of the composite using both XRF and ICP.

CONTACTS:

Bonnie Lavelle
303/312-6579, 303/898-8465

Chris Weis
303/312-6671, 720/320-6254 (cell), 800/759-8888 #1083306 (pager)

Tracy Hammond, SRC
303/713-9549

PROCEDURE

I. Identify Samples for Compositing

1. Evaluate list of candidate samples and minimum quantity provided by Tracy along with neighborhood data. Group by 2 neighborhoods WEST and EAST (and other - may not want to include Globeville or Elyria for this study). Calculate average concentration - consult Bonnie if concentration is too low based on Tracy's mass requirements (target 1100-1200 ppm lead); or eliminate samples from consideration that bring the average down.

2. Note that mass of each composite needed is for Test Substance per Tracy's table, PLUS 50 grams, plus 18 XRF samples, plus 6 ICP samples, and plus some if possible for archive.

3. Retrieve samples from archive for each group.

4. Weigh raw samples; Re-evaluate relative contribution (composite design) of samples (maximize volume of higher Pb concentration samples) in order to achieve target/high Pb concentration in composite. If mass is inadequate to generate WEST and EAST composites, consult EPA for guidance on alternative approach targeting 2 different concentration levels.

II. Prepare Composite

1. Weigh out portions/all of the raw samples per composite design and composite into the two Raw samples. Label each uniquely 3-XXXXX-R. Homogenize very well.

2. Thoroughly dry each raw sample. Bulk sieve each entire composite; Label with sample IDs (-B).

3. Prep one XRF cup for each -B and screen by XRF - confirm adequate sample mass for each composite. If mass is low, dry and bulk sieve additional soil (from appropriate EAST or WEST group), re-homogenize, and re-screen -B.

4. Reserve -B sample quantities adequate for 9 XRF samples and 3 ICP samples.

5. Fine sieve (60 mesh) remaining -B sample mass to produce the two composite -F samples.

III. Split Samples - Bulk

1. Split each -B composite into 3 uniquely identified samples and ship for ICP analysis of all EPA Target Analyte List metals (std or 48-hour turnaround **BONNIE: may be easier to submit all for quick turnaround to enable completion of this task next week, rather than get a separate data package in 3+ weeks).

2. Grind / cup 9 aliquots (original sample ID 3-XXXXX-B1 --> B9 *** BONNIE: does this have to be blind to the XRF analyst? If so, assign unique sample IDs) for XRF analysis

IV. Split Samples - Fine

1. Split each -F composite into 3 uniquely identified samples and ship for ICP analysis of all EPA Target Analyte List metals (48-hour turnaround)

2. Grind / cup 9 aliquots for each (original sample ID 3-XXXXX-F1 --> F9 *** BONNIE: does this have to be blind to the XRF analyst? If so, assign unique sample IDs) for XRF analysis

3. Split each remaining -F composite into a 50-gram sample (for physical testing), a required mass of Test Substance, and any remaining quantity for archive; ALL with same original -F sample ID.

4. Transfer Sample consisting of 50-gram and Test Substance portions to Tracy Hammond (phone her for a pick-up) under COC.

VI. XRF Analysis / Reporting

1. Analyze 9 - B and 9 -F samples from each composite together along with NIST standard and blank.

VII. Documentation

1. Produce a Technical Memorandum summarizing task, include: prep log/XRF instrument log/COCs/ICP data received; three copies to Bonnie.

2. FAX ICP data to Bonnie, Chris and Tracy upon receipt.

# ATTACHMENT 2

# LABORATORY DATA SHEETS FOR TARGET ANALYTE LIST METALS BY ICP

# Total ICP Metals

## Method SW6010
## Sample Results

PRELIMINARY RESULTS

Lab Name: Paragon Analytics, Inc.
Work Order Number: 0010156
Client Name: Morrison Knudsen Corporation
ClientProject ID: V8/I-70 IIIB 4994

Field ID: 3-15622-B
Lab ID: 0010156-1

Sample Matrix: SOIL
% Moisture: 0.2
Date Collected: 19-Oct-00
Date Extracted: 23-Oct-00
Date Analyzed: 23-Oct-00

Prep Batch: IP001023-1
QCBatchID: IP001023-1-1
Run ID: IT001023-1A4
Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1 G
Final Volume: 100 ML
Result Units: MG/KG
File Name: TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 2900 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 1.8 | 2 | 0.26 | B | |
| 7440-38-2 | ARSENIC | 1 | 9.6 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 130 | 10 | 0.018 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.33 | 0.5 | 0.015 | B | |
| 7440-43-9 | CADMIUM | 1 | 1.8 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 3400 | 100 | 0.54 | | |
| 7440-47-3 | CHROMIUM | 1 | 15 | 1 | 0.047 | | |
| 7440-48-4 | COBALT | 1 | 3.1 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 35 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 16000 | 10 | 0.8 | | |
| 7439-92-1 | LEAD | 1 | 610 | 0.3 | 0.14 | | |
| 7439-95-4 | MAGNESIUM | 1 | 1100 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 230 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 8.5 | 2 | 0.078 | | |
| 7440-09-7 | POTASSIUM | 1 | 640 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 1 | 0.5 | 0.27 | | |
| 7440-22-4 | SILVER | 1 | 1 | 1 | 0.063 | U | |
| 7440-23-5 | SODIUM | 1 | 140 | 100 | 0.25 | | |
| 7440-28-0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 9.9 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 300 | 2 | 0.29 | | |

Data Package ID: *IT0010156-1*

# Total ICP Metals

## Method SW6010
## Sample Results

PRELIMINARY RESULTS

Lab Name: Paragon Analytics, Inc.
Work Order Number: 0010156
Client Name: Morrison Knudsen Corporation
ClientProject ID: VB/I-70 IIIB 4994

Field ID: 3-1562J-B
Lab ID: 0010156-2

Sample Matrix: SOIL
% Moisture: 0.2
Date Collected: 19-Oct-00
Date Extracted: 23-Oct-00
Date Analyzed: 23-Oct-00

Prep Batch: IP001023-1
QCBatchID: IP001023-1-1
Run ID: IT001023-1A4
Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1 G
Final Volume: 100 ML
Result Units: MG/KG
File Name: TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 2500 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 1.2 | 2 | 0.26 | B | |
| 7440-38-2 | ARSENIC | 1 | 6.7 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 260 | 10 | 0.016 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.28 | 0.5 | 0.015 | B | |
| 7440-43-9 | CADMIUM | 1 | 2.2 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 4000 | 100 | 0.54 | | |
| 7440-47-3 | CHROMIUM | 1 | 7.1 | 1 | 0.047 | | |
| 7440-48-4 | COBALT | 1 | 2.6 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 24 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 10000 | 10 | 0.8 | | |
| 7439-92-1 | LEAD | 10 | 1100 | 3 | 1.4 | | |
| 7439-95-4 | MAGNESIUM | 1 | 1200 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 260 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 4.5 | 2 | 0.078 | | |
| 7440-09-7 | POTASSIUM | 1 | 780 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 0.68 | 0.5 | 0.27 | | |
| 7440-22-4 | SILVER | 1 | 0.32 | 1 | 0.063 | B | |
| 7440-23-5 | SODIUM | 1 | 140 | 100 | 0.25 | | |
| 7440-28-0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 9.8 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 540 | 2 | 0.29 | | |

Data Package ID: *IT0010156-1*

# Total ICP Metals

## Method SW6010

## Sample Results

PRELIMINARY RESULTS

Lab Name: Paragon Analytics, Inc.
Work Order Number: 0010156
Client Name: Morrison Knudsen Corporation
ClientProject ID: V8/I-70 IIIB 4994

Field ID: 3-1562A-B
Lab ID: 0010156-3

Sample Matrix: SOIL
% Moisture: 0 5
Date Collected: 19-Oct-00
Date Extracted: 23-Oct-00
Date Analyzed: 23-Oct-00

Prep Batch: IP001023-1
QCBatchID: IP001023-1-1
Run ID: IT001023-1A4
Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1 G
Final Volume: 100 ML
Result Units: MG/KG
File Name: TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 2800 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 0.67 | 2 | 0.27 | B | |
| 7440-38-2 | ARSENIC | 1 | 9.5 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 130 | 10 | 0.018 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.34 | 0.5 | 0.015 | B | |
| 7440-43-9 | CADMIUM | 1 | 2.2 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 4100 | 100 | 0.54 | | |
| 7440-47-3 | CHROMIUM | 1 | 7.3 | 1 | 0.048 | | |
| 7440-48-4 | COBALT | 1 | 2.9 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 21 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 7700 | 10 | 0.8 | | |
| 7439-92-1 | LEAD | 1 | 620 | 0.3 | 0.14 | | |
| 7439-95-4 | MAGNESIUM | 1 | 1200 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 180 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 5 2 | 2 | 0.078 | | |
| 7440-09-7 | POTASSIUM | 1 | 920 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 0.38 | 0.5 | 0.27 | B | |
| 7440-22-4 | SILVER | 1 | 0.16 | 1 | 0.063 | B | |
| 7440-23-5 | SODIUM | 1 | 160 | 100 | 0.25 | | |
| 7440-28 0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 10 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 300 | 2 | 0.29 | | |

Data Package ID: *IT0010156-1*

# Total ICP Metals

## Method SW6010
## Sample Results

PRELIMINARY RESULTS

Lab Name: Paragon Analytics, Inc.
Work Order Number: 0010156
Client Name: Morrison Knudsen Corporation
ClientProject ID: V8/I-70 IIIB 4994

Field ID: 3-15627-F
Lab ID: 0010156-4

Sample Matrix: SOIL
% Moisture: 0.5
Date Collected: 19-Oct-00
Date Extracted: 23-Oct 00
Date Analyzed: 23-Oct-00

Prep Batch: IP001023-1
QCBatchID: IP001023-1-1
Run ID: IT001023-1A4
Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1 G
Final Volume: 100 ML
Result Units: MG/KG
File Name: TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 7000 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 1.6 | 2 | 0.27 | B | |
| 7440-38-2 | ARSENIC | 1 | 19 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 290 | 10 | 0.018 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.71 | 0.5 | 0.015 | | |
| 7440-43-9 | CADMIUM | 1 | 5.4 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 6500 | 100 | 0.54 | | |
| 7440-47-3 | CHROMIUM | 1 | 21 | 1 | 0.048 | | |
| 7440-48-4 | COBALT | 1 | 6.4 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 71 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 16000 | 10 | 0.8 | | |
| 7439-92-1 | LEAD | 1 | 700 | 0.3 | 0.14 | | |
| 7439-95-4 | MAGNESIUM | 1 | 2400 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 360 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 12 | 2 | 0.078 | | |
| 7440-09-7 | POTASSIUM | 1 | 2600 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 1 | 0.5 | 0.27 | | |
| 7440-22-4 | SILVER | 1 | 0.68 | 1 | 0.063 | B | |
| 7440-23-5 | SODIUM | 1 | 280 | 100 | 0.25 | | |
| 7440-28-0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 24 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 620 | 2 | 0.29 | | |

Data Package ID: *IT0010156-1*

# Total ICP Metals

## Method SW6010

## Sample Results

PRELIMINARY RESULTS

Lab Name: Paragon Analytics, Inc.
Work Order Number: 0010156
Client Name: Morrison Knudsen Corporation
ClientProject ID: VB/I-70 IIIB 4994

Field ID: 3-15629-F
Lab ID: 0010156-5

Sample Matrix: SOIL
% Moisture: 0.4
Date Collected: 19-Oct-00
Date Extracted: 23-Oct-00
Date Analyzed: 23-Oct-00

Prep Batch: IP001023-1
QCBatchID: IP001023-1-1
Run ID: IT001023-1A4
Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1 G
Final Volume: 100 ML
Result Units: MG/KG
File Name: TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 7500 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 1.6 | 2 | 0.27 | B | |
| 7440-38-2 | ARSENIC | 1 | 19 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 310 | 10 | 0.018 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.73 | 0.5 | 0.015 | | |
| 7440-43-9 | CADMIUM | 1 | 5.5 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 6600 | 100 | 0.54 | | |
| 7440-47-3 | CHROMIUM | 1 | 21 | 1 | 0.048 | | |
| 7440-48-4 | COBALT | 1 | 6.5 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 63 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 17000 | 10 | 0.8 | | |
| 7439-92-1 | LEAD | 1 | 710 | 0.3 | 0.14 | | |
| 7439-95-4 | MAGNESIUM | 1 | 2500 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 400 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 12 | 2 | 0.078 | | |
| 7440-09-7 | POTASSIUM | 1 | 2700 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 1.2 | 0.5 | 0.27 | | |
| 7440-22-4 | SILVER | 1 | 0.69 | 1 | 0.063 | B | |
| 7440-23-5 | SODIUM | 1 | 270 | 100 | 0.25 | | |
| 7440-28-0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 24 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 620 | 2 | 0.29 | | |

Data Package ID: *IT0010156-1*

# Total ICP Metals

## Method SW6010

## Sample Results

PRELIMINARY RESULTS

Lab Name: Paragon Analytics, Inc.
Work Order Number: 0010156
Client Name: Morrison Knudsen Corporation
ClientProject ID: VB/I-70 IIIB 4994

Field ID: 3-15630-F
Lab ID: 0010156-6

Sample Matrix: SOIL
% Moisture: 0.2
Date Collected: 19-Oct-00
Date Extracted: 23-Oct-00
Date Analyzed: 23-Oct-00

Prep Batch: IP001023-1
QCBatchID: IP001023-1-1
Run ID: IT001023-1A4
Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1 G
Final Volume: 100 ML
Result Units: MG/KG
File Name: TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 8000 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 1.8 | 2 | 0.26 | B | |
| 7440-38-2 | ARSENIC | 1 | 20 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 310 | 10 | 0.018 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.77 | 0.5 | 0.015 | | |
| 7440-43-9 | CADMIUM | 1 | 5.7 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 7000 | 100 | 0.54 | | |
| 7440-47-3 | CHROMIUM | 1 | 21 | 1 | 0.047 | | |
| 7440-48-4 | COBALT | 1 | 6.9 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 64 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 18000 | 10 | 0.6 | | |
| 7439-92-1 | LEAD | 1 | 760 | 0.3 | 0.14 | | |
| 7439-95-4 | MAGNESIUM | 1 | 2700 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 410 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 13 | 2 | 0.078 | | |
| 7440-09-7 | POTASSIUM | 1 | 2900 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 0.97 | 0.5 | 0.27 | | |
| 7440-22-4 | SILVER | 1 | 0.77 | 1 | 0.053 | B | |
| 7440-23-5 | SODIUM | 1 | 300 | 100 | 0.25 | | |
| 7440-28-0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 26 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 550 | 2 | 0.29 | | |

Data Package ID: *IT0010156-1*

# Total ICP Metals

## Method SW6010
## Sample Results

PRELIMINARY RESULTS

Lab Name: Paragon Analytics, Inc.
Work Order Number: 0010156
Client Name: Morrison Knudsen Corporation
ClientProject ID: VB/I-70 IIIB 4994

Field ID: 3-15703-B
Lab ID: 0010156-7

Sample Matrix: SOIL
% Moisture: 0.2
Date Collected: 19-Oct-00
Date Extracted: 23-Oct-00
Date Analyzed: 23-Oct-00

Prep Batch: IP001023-1
QCBatchID: IP001023-1-1
Run ID: IT001023-1A4
Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1 G
Final Volume: 100 ML
Result Units: MG/KG
File Name: TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 2600 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 1.5 | 2 | 0.26 | B | |
| 7440-38-2 | ARSENIC | 1 | 9.8 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 160 | 10 | 0.018 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.31 | 0.5 | 0.015 | B | |
| 7440-43-9 | CADMIUM | 1 | 2.1 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 3000 | 100 | 0.54 | | |
| 7440-47-3 | CHROMIUM | 1 | 9.1 | 1 | 0.047 | | |
| 7440-48-4 | COBALT | 1 | 2.9 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 22 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 6800 | 10 | 0.8 | | |
| 7439-92-1 | LEAD | 1 | 900 | 0.3 | 0.14 | | |
| 7439-95-4 | MAGNESIUM | 1 | 790 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 270 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 4.4 | 2 | 0.078 | | |
| 7440-09-7 | POTASSIUM | 1 | 850 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 0.39 | 0.5 | 0.27 | B | |
| 7440-22-4 | SILVER | 1 | 0.17 | 1 | 0.063 | B | |
| 7440-23-5 | SODIUM | 1 | 120 | 100 | 0.25 | | |
| 7440-28-0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 11 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 400 | 2 | 0.29 | | |

Data Package ID: *IT0010156-1*

# Total ICP Metals

## Method SW6010
## Sample Results

PRELIMINARY RESULTS

**Lab Name:** Paragon Analytics, Inc.
**Work Order Number:** 0010156
**Client Name:** Morrison Knudsen Corporation
**ClientProject ID:** VB/I-70 IIIB 4994

**Field ID:** 3-15704-B
**Lab ID:** 0010156-8

**Sample Matrix:** SOIL
**% Moisture:** 0.3
**Date Collected:** 19-Oct-00
**Date Extracted:** 23-Oct-00
**Date Analyzed:** 23-Oct-00

**Prep Batch:** IP001023-1
**QCBatchID:** IP001023-1-1
**Run ID:** IT001023-1A4
**Cleanup:** NONE
**Basis:** Dry Weight

**Sample Aliquot:** 1 G
**Final Volume:** 100 ML
**Result Units:** MG/KG
**File Name:** TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 2200 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 0.67 | 2 | 0.26 | B | |
| 7440-38-2 | ARSENIC | 1 | 0.1 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 100 | 10 | 0.018 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.3 | 0.5 | 0.015 | B | |
| 7440-43-9 | CADMIUM | 1 | 1.8 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 2900 | 100 | 0.54 | | |
| 7440-47-3 | CHROMIUM | 1 | 7.9 | 1 | 0.048 | | |
| 7440-48-4 | COBALT | 1 | 2.3 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 20 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 6400 | 10 | 0.8 | | |
| 7439-92-1 | LEAD | 1 | 370 | 0.3 | 0.14 | | |
| 7439-95-4 | MAGNESIUM | 1 | 750 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 190 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 3.7 | 2 | 0.078 | | |
| 7440-09-7 | POTASSIUM | 1 | 750 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 0.5 | 0.5 | 0.27 | U | |
| 7440-22-4 | SILVER | 1 | 0.17 | 1 | 0.063 | B | |
| 7440-23-5 | SODIUM | 1 | 76 | 100 | 0.25 | B | |
| 7440-28-0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 8.2 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 240 | 2 | 0.29 | | |

**Data Package ID:** *IT0010156-1*

# Total ICP Metals

## Method SW6010
## Sample Results

PRELIMINARY RESULTS

Lab Name: Paragon Analytics, Inc.
Work Order Number: 0010156
Client Name: Morrison Knudsen Corporation
ClientProject ID: VB/I-70 IIIB 4994

Field ID: 3-15/05-R
Lab ID: 0010156-9

Sample Matrix: SOIL
% Moisture: 0.1
Date Collected: 19-Oct-00
Date Extracted: 23-Oct-00
Date Analyzed: 23-Oct-00

Prep Batch: IP001023-1
QCBatchID: IP001023-1-1
Run ID: IT001023-1A4
Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1 G
Final Volume: 100 ML
Result Units: MG/KG
File Name: TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 2500 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 1 | 2 | 0.26 | B | |
| 7440-38-2 | ARSENIC | 1 | 9.8 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 130 | 10 | 0.018 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.31 | 0.5 | 0.015 | B | |
| 7440-43-9 | CADMIUM | 1 | 1.9 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 3100 | 100 | 0.53 | | |
| 7440-47-3 | CHROMIUM | 1 | 9.7 | 1 | 0.047 | | |
| 7440-48-4 | COBALT | 1 | 4 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 28 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 8000 | 10 | 0.8 | | |
| 7439-92-1 | LEAD | 1 | 400 | 0.3 | 0.14 | | |
| 7439-95-4 | MAGNESIUM | 1 | 760 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 260 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 4.2 | 2 | 0.078 | | |
| 7440-09-7 | POTASSIUM | 1 | 850 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 0.31 | 0.5 | 0.27 | B | |
| 7440-22-4 | SILVER | 1 | 0.38 | 1 | 0.063 | B | |
| 7440-23-5 | SODIUM | 1 | 68 | 100 | 0.25 | B | |
| 7440-28-0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 9.3 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 320 | 2 | 0.29 | | |

Data Package ID: *IT0010156-1*

# Total ICP Metals

## Method SW6010
## Sample Results

PRELIMINARY RESULTS

Lab Name: Paragon Analytics, Inc.
Work Order Number: 0010156
Client Name: Morrison Knudsen Corporation
Client/Project ID: VB/I-70 IIIB 4994

Field ID: 3-15700-F
Lab ID: 0010156-10

Sample Matrix: SOIL
% Moisture: 0.3
Date Collected: 19-Oct-00
Date Extracted: 23-Oct-00
Date Analyzed: 23-Oct-00

Prep Batch: IP001023-1
QCBatchID: IP001023-1-1
Run ID: IT001023-1A4
Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1 G
Final Volume: 100 ML
Result Units: MG/KG
File Name: TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 5900 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 2.3 | 2 | 0.26 | | |
| 7440-38-2 | ARSENIC | 1 | 26 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 200 | 10 | 0.018 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.66 | 0.5 | 0.015 | | |
| 7440-43-9 | CADMIUM | 1 | 4.2 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 6200 | 100 | 0.54 | | |
| 7440-47-3 | CHROMIUM | 1 | 21 | 1 | 0.048 | | |
| 7440-48-4 | COBALT | 1 | 5.5 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 54 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 16000 | 10 | 0.8 | | |
| 7439-92-1 | LEAD | 1 | 970 | 0.3 | 0.14 | | |
| 7439-95-4 | MAGNESIUM | 1 | 1600 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 410 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 9.5 | 2 | 0.076 | | |
| 7440-09-7 | POTASSIUM | 1 | 2000 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 1 | 0.5 | 0.27 | | |
| 7440-22-4 | SILVER | 1 | 0.81 | 1 | 0.063 | B | |
| 7440-23-5 | SODIUM | 1 | 150 | 100 | 0.25 | | |
| 7440-28-0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 23 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 540 | 2 | 0.29 | | |

Data Package ID: *IT0010156-1*

# Total ICP Metals

## Method SW6010
## Sample Results

PRELIMINARY RESULTS

Lab Name: Paragon Analytics, Inc.
Work Order Number: 0010156
Client Name: Morrison Knudsen Corporation
ClientProject ID: VIII-70 IIIB 4994

Field ID: 3-15701-F
Lab ID: 0010156-11

Sample Matrix: SOIL
% Moisture: 0.2
Date Collected: 19-Oct-00
Date Extracted: 23-Oct-00
Date Analyzed: 23-Oct-00

Prep Batch: IP001023-1
QCBatchID: IP001023-1-1
Run ID: IT001023-1A4
Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1 G
Final Volume: 100 ML
Result Units: MG/KG
File Name: TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 6100 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 2 | 2 | 0.26 | B | N |
| 7440-38-2 | ARSENIC | 1 | 25 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 300 | 10 | 0.018 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.67 | 0.5 | 0.015 | | |
| 7440-43-9 | CADMIUM | 1 | 4.3 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 6200 | 100 | 0.54 | | |
| 7440-47-3 | CHROMIUM | 1 | 21 | 1 | 0.047 | | |
| 7440-48-4 | COBALT | 1 | 5.5 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 54 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 16000 | 10 | 0.8 | | |
| 7439-92-1 | LEAD | 10 | 1000 | 3 | 1.4 | | |
| 7439-95-4 | MAGNESIUM | 1 | 1800 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 430 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 9.6 | 2 | 0.078 | | |
| 7440-09-7 | POTASSIUM | 1 | 2000 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 1.1 | 0.5 | 0.27 | | |
| 7440-22-4 | SILVER | 1 | 0.77 | 1 | 0.063 | B | |
| 7440-23-5 | SODIUM | 1 | 160 | 100 | 0.25 | | E |
| 7440-28-0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 23 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 560 | 2 | 0.29 | | |

Data Package ID: *IT0010156-1*

# Total ICP Metals

## Method SW6010

## Sample Results

PRELIMINARY RESULTS

Lab Name: Paragon Analytics, Inc.
Work Order Number: 0010156
Client Name: Morrison Knudsen Corporation
ClientProject ID: VB/I-70 IIIB 4994

Field ID: 3-15702-F
Lab ID: 0010156-12

Sample Matrix: SOIL
% Moisture: 0.3
Date Collected: 19-Oct-00
Date Extracted: 23-Oct-00
Date Analyzed: 23-Oct-00

Prep Batch: IP001023-1
QCBatchID: IP001023-1-1
Run ID: IT001023-1A4
Cleanup: NONE
Basis: Dry Weight

Sample Aliquot: 1 G
Final Volume: 100 ML
Result Units: MG/KG
File Name: TS01023

| CASNO | Target Analyte | Dilution Factor | Result | Reporting Limit | MDL | Result Qualifier | EPA Qualifier |
|---|---|---|---|---|---|---|---|
| 7429-90-5 | ALUMINUM | 1 | 5500 | 20 | 0.69 | | |
| 7440-36-0 | ANTIMONY | 1 | 0.91 | 2 | 0.26 | B | |
| 7440-38-2 | ARSENIC | 1 | 24 | 1 | 0.28 | | |
| 7440-39-3 | BARIUM | 1 | 290 | 10 | 0.018 | | |
| 7440-41-7 | BERYLLIUM | 1 | 0.61 | 0.5 | 0.015 | | |
| 7440-43-9 | CADMIUM | 1 | 4.2 | 0.5 | 0.017 | | |
| 7440-70-2 | CALCIUM | 1 | 6100 | 100 | 0.54 | | |
| 7440-47-3 | CHROMIUM | 1 | 18 | 1 | 0.048 | | |
| 7440-48-4 | COBALT | 1 | 4.5 | 1 | 0.05 | | |
| 7440-50-8 | COPPER | 1 | 50 | 1 | 0.032 | | |
| 7439-89-6 | IRON | 1 | 11000 | 10 | 0.8 | | |
| 7439-92-1 | LEAD | 1 | 990 | 0.3 | 0.14 | | |
| 7439-95-4 | MAGNESIUM | 1 | 1700 | 100 | 0.79 | | |
| 7439-96-5 | MANGANESE | 1 | 400 | 1 | 0.025 | | |
| 7440-02-0 | NICKEL | 1 | 8.4 | 2 | 0.078 | | |
| 7440-09-7 | POTASSIUM | 1 | 2100 | 100 | 5.3 | | |
| 7782-49-2 | SELENIUM | 1 | 1.2 | 0.5 | 0.27 | | |
| 7440-22-4 | SILVER | 1 | 0.61 | 1 | 0.063 | B | |
| 7440-23-5 | SODIUM | 1 | 180 | 100 | 0.25 | | |
| 7440-28-0 | THALLIUM | 1 | 1 | 1 | 0.39 | U | |
| 7440-62-2 | VANADIUM | 1 | 16 | 1 | 0.033 | | |
| 7440-66-6 | ZINC | 1 | 540 | 2 | 0.29 | | |

Data Package ID: *IT0010156-1*

# Total MERCURY

PRELIMINARY RESULTS

## Method SW7471

## Sample Results

Lab Name: Paragon Analytics, Inc.
Client Name: Morrison Knudsen Corporation
Client Project ID: VB/I-70 IIIB 4984
Work Order Number: 0010156
Reporting Basis: Dry Weight

Final Volume: 100 ML
Matrix: SOIL
Result Units: MG/KG

| Client Sample ID | Lab ID | Date Collected | Date Prepared | Date Analyzed | Percent Moisture | Dilution Factor | Result | Reporting Limit | MDL | Flag | Sample Aliquot |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3-15622-B | 0010156-1 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.2 | 1 | 0.63 | 0.1 | 0.0028 | | .6 G |
| 3-15623-B | 0010156-2 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.2 | 1 | 0.59 | 0.1 | 0.0028 | | .6 G |
| 3-15624-B | 0010156-3 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.5 | 1 | 0.68 | 0.1 | 0.0028 | | .6 G |
| 3-15627-F | 0010156-4 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.5 | 1 | 1.6 | 0.1 | 0.0028 | | .6 G |
| 3-15629-F | 0010156-5 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.4 | 1 | 1.6 | 0.1 | 0.0028 | | .6 G |
| 3-15630-F | 0010156-6 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.2 | 2 / | 1.8 ~~1~~ | 0.2 ~~0.1~~ | 0.0028 ~~0.0028~~ | | .6 G |
| 3-15703-B | 0010156-7 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.2 | 1 | 0.22 | 0.1 | 0.0028 | | .6 G |
| 3-15704-B | 0010156-8 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.3 | 1 | 0.25 | 0.1 | 0.0028 | | .6 G |
| 3-15705-B | 0010156-9 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.1 | 1 | 0.23 | 0.1 | 0.0028 | | .6 G |
| 3-15700-F | 0010156-10 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.3 | 1 | 0.6 | 0.1 | 0.0028 | | .6 G |
| 3-15701-F | 0010156-11 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.2 | 1 | 0.56 | 0.1 | 0.0028 | N | .6 G |
| 3-15702-F | 0010156-12 | 10/19/2000 | 10/23/2000 | 10/23/2000 | 0.3 | 1 | 0.66 | 0.1 | 0.0028 | | .6 G |

Comments:

1. ND or U = Not Detected at or above the client requested detection limit.

Data Package ID: *HG0010156-1*